# ELECTRONIC WAU CONTROLLER

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This thesis is Part Fulfillment of the Requirement for a Bachelor Degree of Electrical Engineering (Electronic)

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MAY 2009

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"I hereby acknowledge that the scope and quality of this thesis is qualified for the award of the Bachelor Degree of Electrical Engineering (Electronics)"

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Date : 11 MAY 2009

To my beloved mother and father

**ACKNOWLEDGEMENT**

I would like to thank my supervisor IR Zulkiflee Khalidin for this advice and support throught this project. Without his continoud support and interest, this thesis would not have been the same as presented here.

My sincere appreciation also extands to all the lecturers and staffs that have provided assistance at various occasions. Their views and tips are useful indeed.

I also would like to express my gratitude to my collegues for their full co-operation during doing this project.

I also wish acknowledgement to the people who give support direct or inderectly to the project and during the thesis writing and I also would like to thanks my beloved family for not forget to pray and giving support to me. Once again, thank you very much.

## ABSTRACT

Traditionally, after the harvesting of padi, the people will rejoice and take part in kite-flying sport, when farmers have spare time to decorate and fly these Wau. There are many type of Wau in Malaysia and it controlled by human using a rope to control the movement of this Wau. The purpose of this project is to control the Wau without using the rope. It will be control by using remote control. A remote control system for providing a remote control signal for controlling a device from a distance. This project involving hardware, software, and electrical sub-systems. The hardware required includes a flight vehicle, which is a commercial remote control.. The software systems on the ground must transmit commands, and the software in the air must process commands and data to stabilize and fly the Wau. The electrical subsystems include micro-controllers and computers required to support the software

# ABSTRAK

Kebiasaannya, selepas menuai padi, petani akan bergembira dan mengambil bahagian dalam permaianan laying-layang atau Wau yang di reka dan dibuat sendiri. Di Malaysia, terdapat pelbagai jenis Wau dan Wau tersebut akan dikawal oleh manusia dengan mengawal tali yang telah diikat pada Wau. Jadi, tujuan projek ini adalah untuk menaikkan dan mengawal Wau tersebut tanpa menggunakan tali sebaliknya ianya dikawal dengan menggunakan sistem kawalan jauh. Projek ini terdiri daripada perkakasan, perisian dan sub sistem elektrik. Perkakasan termasuklah Wau dan sistem kawalan jauh. Sistem perisan bagi alat kawalan jauh akan menghantar arahan dan sistem elektrikal pada Wau akan menerima data dan memproses data tersebut untuk membuatkan Wau terbang. Bagi sub sistem elektrik pula, terdiri daripada mikro kawalan dan computer

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| | | |
|---|---|---|
| K | - | Kilo |
| p | - | Pico |
| F | - | Farad |
| M | - | Mega |
| Hz | - | Hertz |
| Ω | - | Ohm |

# CHAPTER 1

# INTRODUCTION

## 1.1 Background

This section explains details about an overview of project, problem statement, objectives of project, scopes of project and thesis outline.

## 1.2 Overview of project

Traditionally, after the harvesting of padi, the people will rejoice and take part in kite-flying sport, when farmers have spare time to decorate and fly these Wau. There are many type of Wau in Malaysia and it controlled by human using a rope to control the movement of this Wau.

The purpose of this project is to control the Wau without using the rope. It will be control by using remote control. A system comprising: a remote control system for providing a remote control signal for controlling a device from a distance. A controller is a hand-held device that sends radio signals to the radio receiver in the Wau Controller to tell it what to do. The controller is also called a transmitter because it transmits signals that control the movement of the Wau. For this project, the remote control used two joysticks to control the Wau. The controller is also described based on the number of actions or channels it controls.

## 1.3 Problem Statement

The Wau usually controlled by the user using the rope to control the movement. The problem is while the strong wind coming it is difficult to control the Wau and the rope that control the Wau easily cut off. The Wau also playing only while have the wind to make it up and move in right or left direction. The solution for this problem is designed the Wau that controlled by electronic controller.

## 1.4 Objectives of project

The kind objectives of this project are to make the Wau flying by using electronic controller that controlled by user. Besides, the Wau also can go up and down and turn left and turn right.

## 1.5 Scope of project

The scope that used in this project includes two parts which are transmitter and receiver.

### 1.5.1 Transmitter

In this project, transmitter used to transmit the digital signal from the device. Transmitter will modulate the signal and send this encoded value to the receiver via an antenna.

### 1.5.2 Receiver

Receiver used to receive the signals that transmit from transmitter by an antenna. Receiver have to amplify a low level signal as received from antenna, demodulate the signal and amplify the base band signal to a level power.

## 1.6 Thesis Outline

Chapter 1 explains the background of the project with it is an overview of project, problem statement, objectives of project and scopes of project. The transmitter and receiver are the main essential in this project.

Chapter 2 focused on the literature review. All information from journals, books and sources from website that have some attachment to this project are used as a reference to guide and help completing this project. Each of this part explains based on this finding.

Chapter 3 explains and discuss about the methodology that have been used in order to complete this project. There are two parts in this chapter which are hardware implementation and software development. The discussion will be focused on circuit design.

Chapter 4 discussed about the result obtained and limitation of the project. All discussion is concentrating on the result and performance of the device

Chapter 5 discussed the conclusion of development of this project. This chapter also discusses the recommendation for this system for future development or implementation.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Background

This chapter focused on the literature review for each component in this project. The entire component is described based on the finding during the completion of this project.

### 2.1.1 Helicopter controller

This project is design basically from helicopter controller. As we know the speeds of helicopter controller is fast but for this project will modified to make the Wau operate or function with smoothly movement. It is because the project perpetuates our nature Wau although it is used modern technology. This applet models a high-attitude take off motion of a Wau with a modal controller. The x, z-axes of the spatial frame are

pointing north and down. The body x-axis is defined from the center of gravity to the nose of the Wau, and body z-axis is pointing down from the center of gravity. The motion of the Wau is controlled by the main rotor thrust, and the longitudinal tilt path angle. Flight modes represent different modes of operation of the Wau and they correspond to controlling different variables in the dynamic.

The infrared (I.R.) sensor works by using an I.R. led to emit a series of pulses of I.R. light. A sensitive circuit using a photodiode detects this signal as reflected by an obstructing object the robot might encounter. Comparators then process the signal and provide the logic for reversing the left motor. The existing robot kit is hence an excellent baseline circuit to which the microcontroller is added and provides a number of pieces of circuitry required in the final version of the robot: the I.R. sensor, motors, and associated driving transistors for the motors.

Wau can make a flight by rotating the main rotor, with the wings (blades) thereof adjusted to a certain attack angle, thus producing a lift. The steering is performed to four-axis control directions including roll, pitch, collective pitch, and yaw. The roll axis, the pitch axis, the collective axis, and the yaw axis are controlled by adjusting the rotor pitch angle of the rotating plane of the main rotor of a Wau. For this control, a swash plate, which is disposed coaxially on the rotating shaft of the main rotor and of which the three axes have the degree of freedom, is controlled by means of servomechanisms.

A steering control device suitable for a radio-controlled model, comprising a receiver for receiving three steering signals serially transmitted from a transmitter and demodulating the signals, and then outputting three servo control signals, said three steering signals including a roll steering signal, a pitch steering signal, and a collective pitch steering signal, said three servo control signals including a roll servo control signal, a pitch servo control signal, and a collective pitch servo control signal, a controller for mixing as manipulation signals for three axes of rotation, said three servo control signals output from said receiver and then outputting three servo drive signals for the three axes of rotation, said three servo drive signals including a roll servo drive

signal, a pitch servo drive signal and a collective pitch servo drive signal; a synchronous circuit for synchronizing said three servo drive signals output from said controller and outputting said three servo drive signals in parallel; and a roll servo mechanism, a pitch servo mechanism, and a collective pitch servo mechanism, which are controllably driven respectively by said three servo drive signals.

### 2.1.2 Transmitter and Receiver Concept

A transceiver is a device that has both a transmitter and a receivers which is combined and share common circuitry or a single housing. If no circuitry is common between transmit and receive functions, the device is a transmitter-receiver. The term originated in the early 1920s. Technically, transceivers must combine a significant amount of the transmitter and receiver handling circuitry. Similar devices include transponders, transverters, and repeaters.

### 2.1.3 Frequency Allocation Concept

The electromagnetic spectrum is an aspect of the physical world, like land, water, and air. It is a resource, limited by its usability. Use of radio frequency bands of the electromagnetic spectrum is regulated by governments in most countries, in a process known as frequency allocation or spectrum allocation. Like weather and internationally traded goods, radio propagation and RF technology do not stop at national boundaries. Giving technical and economic reasons, governments have sought to harmonies

spectrum allocation standards. As a matter of physics, many objects and actions generate low-level, wide-band radiation. The frequency allocation process traditionally has not been concerned with many types of radiation.

# CHAPTER 3

# METHODOLOGY

## 3.1 Background

This chapter discussed about circuit designed and components used to complete this project. The discussion will be focused on transmitter circuit that contained the joysticks, microcontroller, RF module and an antenna used to transmit a signal. For receiver circuit will focused on an antenna used to receive a signal from transmitter, microcontroller, RF module and servo motor.

## 3.2 Hardware Components System

The overall system configuration is briefly represented in this section and the hardware used in this research and the physical integration of the components are also

described  This project has two circuit which are circuit for remote control system, also called transmitter and circuit for Wau, also called receiver.  Remote control system will control the Wau by sending the signal to the Wau.  This system has two channels movement means first channel used to control up and down movement and second channel to make the Wau turn left or turn right.

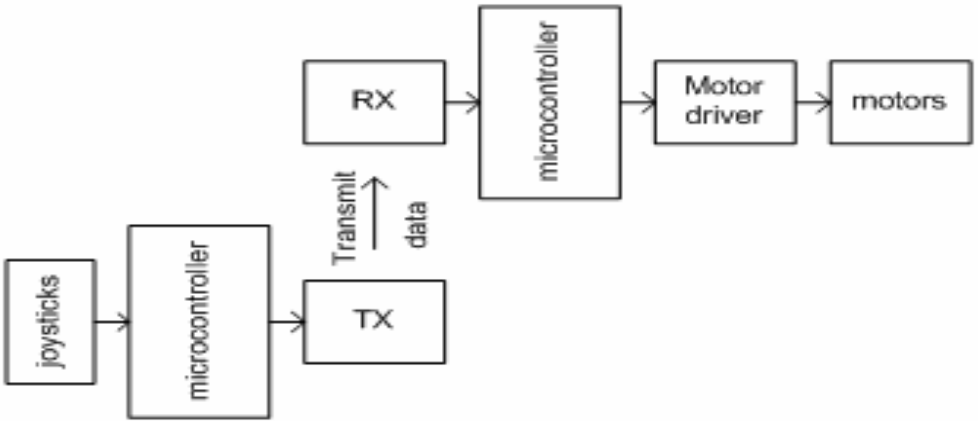


Figure 3.1: Basic block diagram of the project

Block diagram above shows that the joysticks will give command in analogue signal and then microcontroller will convert these analogue signal to digital signal and transmit these encoded value to the receiver.  The receiver receives transmitted commands and decoded this value.  The output signal then used to drive repetitive servo motor.

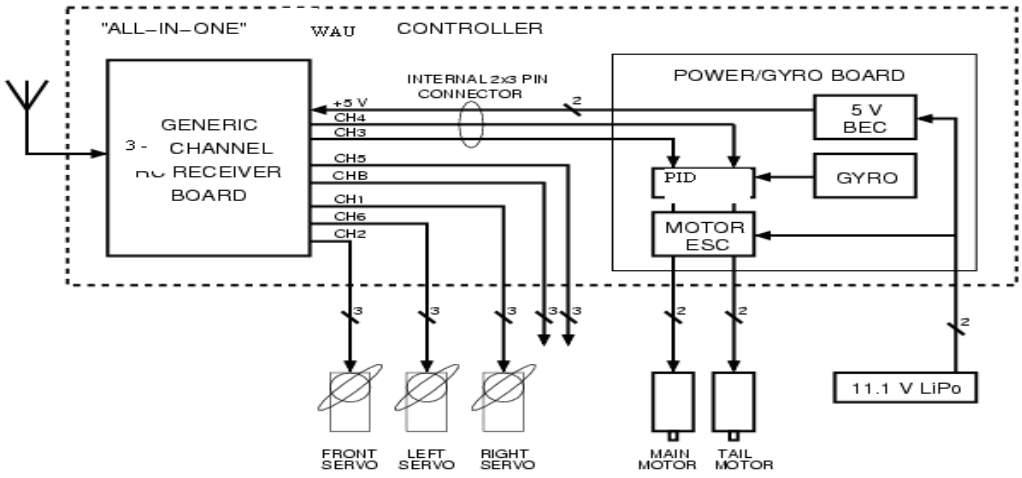


Figure 3.2: Contents of the integrated controller

The controller board must use PWM signals. Generating PCM signals would require more work, especially if proprietary encodings are used. The controller board also must expose the multiplexed PPM signal between the FM radio receiver and the demultiplexer, or at least the PWM inputs to the motor ESCs.

| Channel | Usage |
|---|---|
| 1 | Right servo |
| 2 | Front servo |
| 3 | Main motor (internally connected to the power/gyro board) |
| 4 | Tail rotor (internally connected to the power/gyro board) |
| 5 | Unused |
| 6 | Left servo |

Table 3.1: RC receiver PWM outputs